Helping Your Child

Learn Mathematics

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Helping Your Child Learn Mathematics

With activities for children in preschool through grade 5

U.S. Department of Education
Office of Intergovernmental and Interagency Affairs

Foreword

We know from research that children are more likely to be successful learners of any subject when parents actively support their learning[1]. Today, helping children to make the effort to learn, appreciate and master mathematics is more important than ever. Our increasingly technological world demands strong skills in mathematics, not only in the workforce but also in everyday life, and these demands will only increase over the lifetimes of our children.

To ensure that our children are ready for high school and on track for success in college and the workforce, parents must become involved early—and stay involved over the school years—to reinforce children's skills in and positive attitudes toward mathematics.

Starting in elementary school, children should be learning beginning concepts in algebra, geometry, measurement, statistics and logic. In addition, they should be learning how to solve problems by applying knowledge of math to new situations. They should be learning to think of themselves as mathematicians—able to reason mathematically and to communicate mathematical ideas by talking and writing.

Through the *No Child Left Behind Act of 2001*, President George W. Bush has made clear his commitment to the goals of raising standards of achievement for all children and providing all children with highly qualified teachers and instruction that is based on scientific research. *Helping Your Child Learn Mathematics* is part of the president's efforts to provide parents with the latest research and practical information that can help them both to support children's learning at home and to understand what they should expect from their children's schools.

This booklet includes a range of activities for families with children from preschool age through grade 5. These activities use materials found inside your home and also make learning experiences out of everyday routines, such as grocery shopping and doing laundry. The activities are designed for you to have fun with your child while developing and reinforcing mathematical skills. We hope you and your child will enjoy the activities suggested in this booklet and develop many more of your own.

1. Hoover-Dempsey and Sandler, 3-42.

Contents

Too many of America's young people are not literate in mathematics and science. Too many are graduating from high school without the skills or the knowledge to take their places in the fields of mathematics, engineering and science—all critical to maintaining America's leadership in the world. It is paramount that America graduate greater numbers of young people who are strong in mathematics and science. Our future depends on them to lead the way in developing strategies and technologies that will keep us safe and prosperous for generations to come.

—Rod Paige
U. S. Secretary of Education

Introduction

What kind of attitude do you have toward math? Do you believe that math skills are important job and life skills? Do you see math as useful in everyday life? Or do you dread doing things that involve math—figuring out how much new carpet you'll need, balancing the checkbook, reading the technical manual that came with the DVD player? How you answer these questions indicates how you may be influencing your child's attitudes toward math—and how he* approaches learning math.

Although parents can be a positive force in helping children learn math, they also can undermine their children's math ability and attitudes by saying things such as: "Math is hard," or "I'm not surprised you don't do well in math, I didn't like math either when I was in school," or "I wasn't very good in math and I'm a success, so don't worry about doing well." Although you can't *make* your child like math, you can encourage her to do so, and you can take steps to ensure that she learns to appreciate its value both in her everyday life and in preparing for her future. You might point out to her how fortunate she is to have the opportunity to learn mathematics today—when mathematics knowledge can open the door to so many interesting and exciting possibilities.

In everyday interactions with children, there are many things that parents can do—and do without lecturing or applying pressure—to help children learn to solve problems, to communicate mathematically and to demonstrate reasoning abilities. These skills are fundamental to learning mathematics.

* Please note: In this booklet, we refer to a child as "he" in some places and "she" in others. We do this to make the booklet easier to read. Please understand, however, that every point that we make is the same for boys and girls.

Let's look closely at what it means to be a problem solver, to communicate mathematically and to demonstrate mathematical reasoning ability.

A problem solver is someone who questions, finds, investigates and explores solutions to problems; demonstrates the ability to stick with a problem to find a solution; understands that there may be different ways to arrive at an answer; and applies math successfully to everyday situations. You can encourage your child to be a good problem solver by including him in routine activities that involve math—for example, measuring, weighing, figuring costs and comparing prices of things he wants to buy.

To communicate mathematically means to use mathematical language, numbers, charts or symbols to explain things and to explain the reasoning for solving a problem in a certain way, rather than just giving the answer. It also means careful listening to understand others' ways of thinking and reasoning. You can help your child learn to communicate mathematically by asking her to explain what she must do to solve a math problem or how she arrived at her answer. You could ask your child to draw a picture or diagram to show how she arrived at the answer.

Mathematical reasoning ability means thinking logically, being able to see similarities and differences in objects or problems, making choices based on those differences and thinking about relationships among things. You can encourage your child's mathematical reasoning ability by talking frequently with him about these thought processes.

Some Important Things Your Child Needs to Know About Mathematics

You can help your child learn math by offering her insights into how to approach math. She will develop more confidence in her math ability if she understands the following points:

1. Problems Can Be Solved in Different Ways.

Although most math problems have only one answer, there may be many ways to get to that answer. Learning math is more than finding the correct answer; it's also a process of solving problems and applying what you've learned to new problems.

2. Wrong Answers Sometimes Can Be Useful.

Accuracy is always important in math. However, sometimes you can use a wrong answer to help your child figure out why she made a mistake. Analyzing wrong answers can help your child to understand the concepts underlying the problem and to learn to apply reasoning skills to arrive at the correct answer.

Ask your child to explain how she solved a math problem. Her explanation might help you discover if she needs help with number skills, such as addition, subtraction, multiplication and division, or with the concepts involved in solving the problem.

3. Take Risks!

Help your child to be a risk taker. Help him see the value of trying to solve a problem, even if it's difficult. Give your child time to explore different approaches to solving a difficult problem. As he works, encourage him to talk about what he is thinking. This will help him to strengthen math skills and to become an independent thinker and problem solver.

4. Being Able to Do Mathematics in Your Head Is Important.

Mathematics isn't restricted to pencil and paper activities. Doing math "in your head" (mental math) is a valuable skill that comes in handy as we make quick calculations of costs in stores, restaurants or gas stations. Let your child know that by using mental math, her math skills will become stronger.

5. It's Sometimes OK to Use a Calculator to Solve Mathematics Problems.

It's OK to use calculators to solve math problems—sometimes. They are widely used today, and knowing how to use them correctly is important. The idea is for your child not to fall back on the excuse, "I don't need to know math—I've got a calculator." Let your child know that to use calculators correctly and most efficiently, she will need a strong grounding in math operations—otherwise, how will she know whether the answer she sees displayed is reasonable!

How to Use This Booklet

The major portion of this booklet is made up of activities that you can use with your child to strengthen math skills and build strong positive attitudes toward math. You don't need to be a great mathematician or to have a college degree in math to use them. Your time and interest and the pleasure that you share with your child as part of working together are what matter most.

As the activities pertain to specific mathematical concepts, the booklet provides a glossary defining these concepts (see page 60). Also, at the end of this booklet, you'll find lists of resources, such as books for you and for your child, helpful Web sites and the names of federal agencies that you can contact for more information about how to help your child with math. Let's get started!

Activities

The activities in this section are arranged into four categories: Mathematics in the Home, Mathematics at the Grocery Store, Mathematics on the Go and Mathematics for the Fun of It. For each activity, you'll see a grade span—from preschool through grade 5—that suggests when children should be ready to try it. Of course, children don't always become interested in or learn the same things at the same time. And they don't suddenly stop enjoying one thing and start enjoying another just because they are a little older. You're the best judge of which activity your child is ready to try. For example, you may find that an activity listed for children in grades 1 or 2 works well with your preschooler. On the other hand, you might discover that the same activity may not interest your child until he is in grade 3 or 4.

Feel free to make changes in an activity—shorten or lengthen it—to suit your child's interests and attention span. Most of the things that you might need for these activities are found around most homes.

As a parent, you can help your child *want* to learn in a way no one else can. That desire to learn is a key to your child's success, and, of course, enjoyment is an important motivator for learning. As you choose activities to use with your child, remember that helping him to learn doesn't mean that you can't laugh and have a good time. In fact, you can teach your child a lot through play. And you can play with and make games out of almost any math skill or concept. We hope that you and your child enjoy these activities and that they inspire you to think of additional activities of your own.

Mathematics in the Home

Your home is a great place for you to begin to explore and "talk" mathematics with your child. Incorporating math activities and language into familiar daily routines will show your child how math works in his everyday life and provide him with a safe environment in which to take risks by trying new things.

Rhyme and Sing

Preschool

Young children love to hear, sing and say nursery rhymes and songs. Counting rhymes and songs can be both enjoyable for them and introduce them to basic mathematics concepts, such as number names and number sequence.

What You Need

- Book of nursery rhymes or songs
- Feather

What to Do

- Teach your child the following counting rhyme:

Four Little Ducks

Four little ducks that I once knew,
Fat ducks, skinny ducks, they were, too.
But one little duck with a feather on her back,
She ruled the others with a quack! quack! quack!

Down to the river they all would go,
1, 2, 3, 4, all in a row.
But one little duck with a feather on her back,
She ruled the others with a quack! quack! quack!

—Say the rhyme with your child several times. When she can say the rhyme all the way through, have other family members join you. Give your child a feather and have her lead everyone around the room as you all sing.

- For the following rhyme, show your child how to perform the actions indicated.

Five Little Speckled Frogs

Five little speckled frogs
    (hold up five fingers)
Sitting on a speckled log
    (sit on your heels)
Eating some most delicious bugs
    (pretend to eat)
Yum! Yum!
One jumped into the pool
    (jump)
Where it was nice and cool
    (cross arms over chest and shiver)
Now there are four little speckled frogs.
    (hold up four fingers)
Burr-ump!
    (Continue until no frogs are left.)

—After saying the rhyme, ask your child to hold up the correct number of fingers to show how many frogs are in the rhyme at the beginning. Then have her hold up the correct number of fingers and count to five with you as you say each numeral.

- Teach your child any counting rhymes and songs that were your personal favorites when you were a child, or have your child ask her grandparents what rhymes they knew when they were children. Other counting rhymes, songs and games that you may want to teach your child include "One, Two, Buckle My Shoe," "This Old Man," "Ten in a Bed (Roll Over)" and "One for the Money."

For titles of books that contain counting rhymes and songs, see the list of children's books in the Resources section at the end of this booklet.

Number Hunt

Preschool

By counting, using number names and learning to recognize differences in number values, children build a foundation for the development of number sense and mathematical reasoning.

What You Need

- 3 plastic eggs that come apart (or similar containers)
- Buttons
- Plastic netting

What to Do

- In pieces of netting, loosely wrap different numbers of buttons and place one bag of buttons in each egg. With your child out of the room, hide the eggs.
- Call your child into the room and tell her that you've hidden three eggs and that you want her to find them. As she finds each egg, have her count aloud—"1," "2," "3."
- When she's found all the eggs, have her open each one and take out the bag of buttons (but not open it). Ask her to count how many buttons are in each bag.

Sometimes younger children don't understand that counting means naming numbers in a specific order. This simple point should be reinforced often.

Walk and Count

Preschool–Kindergarten

Ordinary activities can be used to reinforce young children's number sense and introduce them to arithmetic operations, such as addition and subtraction.

What to Do

- Take your child for a walk. You can walk around your neighborhood, through a park, or just around the rooms in your home. As you walk, say silly things for him to do, such as the following:

  —Take two big steps and three little steps.
  —Take three little steps, hop one time, take three big steps.
  —Take one little step, turn around two times.
  —Hop four times, turn around one time.
  —Take three big steps forward and two big steps backward.
- Count aloud each kind of action that your child performs and compliment him for his efforts—"1, 2—1, 2, 3—1, 2. That's great!"
- Let your child turn the tables and say silly things for you to do as you walk.
- For your kindergarten child, expand the activity by asking him to "guess" (estimate) how many of his steps it will it take, for example, to get from the tree to the corner. After he makes his estimate, have him count steps to see how close the estimate is. Next ask him how many of your steps it will take. Will it take you more steps or fewer to go the same distance? Again, have him count to see if his answers are correct.

Throughout the day, find ways to let children practice using arithmetic skills. Ask, for example, "How many magazines came in the mail?" "How many more letters will we need to get to have 10 letters?" "Which are there more of, magazines or letters?"

Find It

Preschool–Kindergarten

Young children may not recognize that numbers are all around them. Pointing out numbers on everyday items increases their number sense.

What You Need

- Boxes, cans and bottles of food and other household supplies

What to Do

- Place several boxes, cans and bottles on the kitchen table. You might use a cereal box, a can of soup and a bottle of dishwashing soap. Sit with your child and point out one or two numbers on each item. (Numbers can be found in the names of some products, as well as in the list of contents and in addresses. However, rather than pointing to a very large number, such as a ZIP code, point to one digit in that code—a 6 or 3 or 8.)
- Point to one of the items and say a number that is easy to see. Ask your child to find it. Then have him look for that number on the other items.
- Have your child choose a number for you to find on one of the containers.

Calling attention to numbers that are all around them lets children know that numbers are important and that they are used for many different purposes.

Sort It Out

Preschool–Kindergarten

Sorting and matching activities introduce young children to many mathematical operations, including classification and measurement.

What You Need

- Pairs of socks of different sizes and colors
- Laundry

What to Do

- When you're sorting and folding clean laundry, have your child join you and do such things as the following:

—Hold up a pair of matching socks that belong to her and say, for example, "These socks go together because each sock is red and each one fits the same size foot—yours!"

—Pick up another sock and ask your child to look through the pile for the sock that matches it. When she chooses a sock, have her tell you how she knows that it's the right one.

—Continue holding up socks until your child has paired them all. If she mispairs any socks, gently correct her by asking her to tell the color of each sock and to put the socks together to see if they are the same size.

—After you've done this activity several times, let your child choose the socks for you to pair. (Occasionally choose a wrong sock to give her the chance to help you correct your mistake!)

- Have your child help you sort the laundry to be washed. Ask her, for example, to put all the blue things together, all the whites, all the towels and so forth. You might also have her count as she sorts. How many towels are there? How many shirts? Try saying, "I count five shirts. Is that right?" Then have your child count aloud the number of shirts. From time to time, give an incorrect number so that she can count the items one by one and show you that you've made a mistake.

> Children need to see that grown-ups also make math mistakes occasionally and that they identify their mistakes and find ways to correct them.

Shape Up

Preschool–Kindergarten

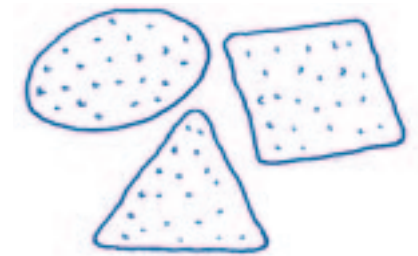
Using objects that are familiar to young children can be a good way to introduce them to differences in shapes and to classification.

What You Need

- Snack crackers in the shape of circles, squares, triangles
- Bread cut into different shapes

What to Do

Here are some simple things that you can do to focus your child's attention on different shapes:

- Fill a bowl with snack crackers in shapes such as circles, triangles and squares. Point to a cracker and say, for example, "Look, this one's round. This one has three sides. See, 1-2-3. This one has four sides. Let's count them—1-2-3-4." Place a circular cracker on the table and ask your child to find other crackers that have the same shape. Continue with the other shapes.
- As you make sandwiches, cut the bread into circles, squares and triangles so that you have two each of each shape. Ask your child to match the pairs of shapes to make Shape Sandwiches.
- Have your child search for and point out different shapes on his clothes or in the room.

> Playing with children can provide many opportunities to engage in activities such as sorting, matching, comparing and arranging.

A-Weigh We Go!

Kindergarten–Grade 1

Observing, estimating, weighing and comparing are all essential mathematics skills.

What You Need

- Bathroom or kitchen scales
- Objects to weigh, such bags of sugar, flour, potatoes or onions; boxes of detergent and cookies; shoes of different sizes
- Paper and pencil
- A small plastic zipper bag filled with sugar and much larger zipper bag filled with cornflakes (or popped popcorn)
- Suitcase

What to Do

- Show your child two objects, such as a five-pound bag of sugar and a 10 pound bag of potatoes, and ask him to guess which weighs the most. Show him how to use a scale to weigh the objects and see if his guess is right or wrong.
- Next show him several objects and ask him to guess how much each weighs. Have him write his estimates, then weigh the objects to see if they're correct.
- If you choose, have your child estimate his own weight, as well as that of other family members, and use the bathroom scale to check his guesses.
- Extend the activity or make it more challenging by doing the following:

—Show your child the small plastic bag filled with sugar and the larger bag filled with cornflakes or popped popcorn. Ask your child which will weigh more, the smaller or the larger bag? Have him weigh the bags to check whether his guess is correct. Afterwards, point out that bigger does not always mean heavier.

—Ask your child how he can weigh a suitcase that is too large to fit on the bathroom scale. Listen carefully to his answers—try some of his suggestions, if possible—and praise him for learning to think through problems. If he doesn't come up with a solution, show him that one way to find the weight of the suitcase is for him to stand on the scales while holding it and noting the total weight. Then put the suitcase aside and weigh himself again and note his weight. If he subtracts his weight from the total weight, the answer is the weight of the suitcase.

> Using simple bathroom and kitchen scales at home prepares children for using equipment in school to weigh and measure.

Penny, Nickel, Dime

Kindergarten–Grade 1

Activities that involve money are a good way to develop mathematical reasoning and to reinforce what children are learning in school about numbers and arithmetic operations, such as addition and subtraction.

What You Need

- Dice
- Pennies, nickels, dimes

What to Do

This is a good game to play with the family.

- Have each player roll the dice and say the number. Then give the player that number of pennies. Explain that each penny is worth one cent.
- When a player gets five pennies, replace the pennies with a nickel. Explain that five pennies have the same value as one nickel—that is, five cents. When she gets five more pennies, replace the pennies and the nickel with a dime. Help her to see that the value of five pennies plus the value of a nickel (five cents) equals 10 cents, which is the value of a dime.
- The first player to reach a set amount—25 or 50 cents, for example—wins.

Children can be confused by money. Some might think that the larger a coin is, the more valuable it is—so a penny or nickel would be more valuable than a dime.

Treasure Hunt

Kindergarten–Grade 1

Once children begin school, math-related activities at home can help to reinforce what they are learning about numbers and arithmetic operations such as addition and subtraction, as well as reinforce classification skills and mathematical reasoning.

What You Need

- Large container
- Buttons, bottle caps, old keys or any other small items that you can count

What to Do

- As a rainy day activity, place the items in the container and give it to your child. Have him sort and classify items into piles: keys, buttons and so forth. Then have him explain how the items in each pile are alike and how they are different. For example, some buttons may be big and some small; some keys may be silver-colored and some gold-colored.
- Have your child choose one of the piles and organize the items in it by one characteristic, such as length. Have him lay the items end to end then compare and contrast what he sees. For example, how many short keys? long keys?
- Next, ask your child to use the items in another pile of items to solve simple math problems. Try problems such as the following:
  —If you have 10 bottle caps and give me two, how many bottle caps do you have left?
  —If you have three big buttons and three small ones, how many buttons do you have altogether?
- Create activities that challenge your child to use mathematical reasoning. Ask him, for example, to look closely at items and answer questions such as the following:
  —Is a gold-colored key always heavier than a silver-colored one?
  —Do the big buttons always have more holes than the smaller ones?

Keeping the tone of math activities light will increase the likelihood that children will want to do them and make the activities seem less like "homework."

In the News(paper)

Kindergarten–Grade 1

Newspapers are good resources for building number sense and arithmetic skills and using mathematical reasoning.

What You Need

- Newspaper
- Safety scissors
- Pencil or crayon
- Glue
- Paper
- Hole puncher
- Yarn

What to Do

- Give your child a newspaper and a set of numbers to look for—for example, from 1 to 25 (or 1 to 100 if she is familiar with the higher numbers). Have her cut out the numbers and glue them in numerical order onto a large piece of paper. Call her attention to any ways in which the numbers differ—for example, some will be in a bigger size of type than others, some will be in bold or italic type. Have her read the numbers to you, then put the paper aside. Have her practice counting up to that number then counting down from it. Also try having her count to the number by 2s or 5s.
- Next, have your child make a counting book by using pictures she's cut from the newspaper. Have her write the page numbers at the bottom of each blank page and paste one item on page 1, two on page 2 and so forth. Explain that all of the things she puts on a page must be alike in some way—all animals, all basketball players, all cars and so on. Help her to write the name of the item on the appropriate page.
- Have your child read the book to you. Afterwards, ask her questions such as the following:

—How many pictures did you cut out altogether *(1+2+. . .+10)?*

—How many total pictures are on pages 1-3? on pages 1-6?

—We know that 6 = 2 x 3. Are there twice as many pictures on page 6 as on page 3?

—Are there twice as many pictures from page 1 to 6 as from pages 1 to 3?

—Which are there more of: pictures on pages 2, 3, and 4, or pictures on pages 5 and 6?

> Newspapers also can be used to help young children learn to recognize numbers in different sizes and kinds of type and to understand that the way a number looks does not change its value.

Fill It Up

Grades 1–2

Filling empty containers provides opportunities to explore geometric concepts, such as “more or less” and volume, and to apply measurement skills.

What You Need

- Measuring cup
- Four large glasses of equal size and shape
- Water

What to Do

- On a table, put the glasses in a row and fill them with water as follows: 1/3 cup, 1/2 cup, 3/4 cup, 1 cup. Ask your child questions that encourage her to compare, estimate and think about measurement. Ask, for example, “Which glass has more water? Which has less?”
- Pour more water into one of the glasses to make it equal to the amount of water in another glass. Move the glasses around so that the glasses that have the same amount of water are not next to each other. Ask your child to find the glasses that have the same amount of water.
- Help your child to do math in her head. Ask questions such as, “If I have four cups of water and I need seven, how many more do I need to pour?”

As you use measuring cups, call attention to the different levels and use their names: “one-fourth,” “one-half” and so on. This will begin to familiarize children with the language they will use when they begin to work with fractions.

Tracking Time

Grades 2–3

Introducing children to statistics and data analysis can begin by having them collect information, analyze it and describe or present their findings in an organized way.

What You Need

- Stopwatch, watch or clock
- Newspaper
- Blank paper
- Graph paper
- Ruler
- Small round object to trace to make a pie chart
- Pencil and markers or crayons

What to Do

- Show your child how to keep track of the time he spends on two activities, such as watching television and doing homework. Help him to make a chart with two columns, one labeled “Television” and one labeled “Homework.” Down the left side of the chart, write the days of the week. Tell him that you want him to write the number of minutes he spends doing each activity on each day. At the end of the week, sit down with him and talk about what the table shows.

- Help your child to make a chart to use as he watches television. Give him a stopwatch (or an easy-to-read clock or watch) and tell him to record how much time of each television show is used for commercials and how much time is used for the actual show. Have him keep the record for one night of viewing. On the graph paper, help him to make a bar graph that shows the different amounts of time devoted to the show and to commercials. Or, show him how to make a pie chart.
- Together with your child, keep track of how he spends time in one 24-hour period: time spent sleeping, eating, playing, reading and going to school. Help him to measure a strip of paper 24 inches long, with each inch representing one hour. Using a different color for each activity, have him color the number of hours he spends in each activity. You and other family members can make similar charts; then your child can compare the charts and see how everyone in the family spends time.

A good way to show children how statistics are used in the "real world" is to call their attention to statistical charts in newspapers and magazines and talk with them about what the charts show and why this information is important.

Fraction Action

Grades 2–3

In introducing children to the concept of *fractions*—numbers that aren't whole numbers (such as 1/2, 1/3 and 1/4)— it's often a good idea to use objects that they can see and touch.

What You Need

- Large clear container (holding at least 2 cups)
- Masking tape
- Marker
- Measuring cups (1/2, 1/3 or 1/4 cup measure)
- Unpopped popcorn

What to Do

- Invite your child to help you make popcorn for the family. Begin by having her put a piece of masking tape from top to bottom on one side of the large container.
- For younger children, use a 1/2 cup measure. For older children, use a 1/3 or 1/4 cup measure. Choose the unit of measure and fill the measuring cup with popcorn. Give the cup to your child and ask her questions such as the following:

  —How many whole cups do you think the container will hold?
  —How many 1/2 cups (or 1/3 cups or 1/4 cups) do you think it will hold?

- Let your child pour the measured popcorn into the clear container. Have her continue to pour the same amount into the container until it is full. As she pours each equal amount, have her mark the level on the container by drawing a line on the tape. Then have her write the fraction, corresponding to the unit of measure on the line. After the container is full, have your child count up the total number of cup increments (1/2, 1/3 or 1/4) and compare it to her estimate from above.
- As you measure out the popcorn to pop, ask your child to answer questions such as the following:

  —How many 1/2 cups equal a cup? Two cups?
  —How many 1/4 cups equal 1/2 cup? A whole cup?
- Pop the corn and enjoy!

Children may reasonably want to say, for example, that 1/4 cup plus 1/4 cup makes 2/4 cups. Letting them work with measuring cups or other measuring devices can let them see that 2/4 is the same as 1/2.

Simply Symmetrical

Grades 3–5

A shape is symmetrical if it can be cut along a straight line into two halves that are mirror images of each other. Learning about symmetry gives children a good sense of geometric principles and calls on their mathematical reasoning abilities.

What You Need

- Shapes such as a circle, a square and a rectangle, cut from heavy paper
- Sheets of paper (rectangular)
- Pencil, marker or crayon
- Magazine pictures of symmetrical objects
- Safety scissors
- Glue

What to Do

- As your child watches, show her the square that you've made. Fold it in half and show her that the two parts are exactly alike—or *symmetrical.* Do the same with the circle and the rectangle. Then give the shapes to your child and ask her to make the folds herself. Extend the activity by having her do the following:

  —Find as many ways as she can to fold half of the square onto the other half. *(There are four ways: two diagonals and two lines "down the middle").*
  —Do the same for the rectangle. *(There are only two ways: down the middle of the long side, then down the middle of the short side. In going from a square to a rectangle, the diagonals are lost as lines of symmetry.)*
  —Do the same with the circle. *(Circles can fold along any diameter. Use this discovery to introduce your child to the word "diameter"—the length of a straight line that passes through the center of a circle).*
  —Ask her to find the center of a circle by folding it in half twice. *(She'll discover that any diameter—line of folding in half—passes through the center of the circle, an activity that will prepare her for understanding more complicated geometry later on.)*

- Show your child a rectangular piece of paper. Ask her, "What shape will you get if you fold this piece of paper in half?" Have her fold the paper, then ask, "Did you get a square or another rectangle?" Using scissors to cut the paper, show her that a rectangle will fold to a square only if it is twice as long as it is wide.
- Fold a sheet of paper in half lengthwise. Have your child draw half of a circle, heart or butterfly from top to bottom along the fold on each side of the paper. Have her cut out the shapes that were drawn. Unfold the paper to see the symmetrical figure.
- Cut out a magazine picture of something that is symmetrical (try, for example, a basketball or a computer screen). Cut it down the center (the line of symmetry). Glue one half of the picture on the paper. Ask your child to draw the missing half.
- With your child, explore your house for symmetrical designs—things that have equal sides. Ask your child how many she can find. Tell her to look at wallpaper, floor tiles, pictures, bedspreads and appliances.
- Have your child print the alphabet. Then ask her to find a letter that has only one line of symmetry—only one way to be divided in half. *(B has one.)* Ask her to find a letter that has two lines of symmetry—two ways to be divided in half. *(H has two.)* Ask which letters look the same when they're turned upside down? *(H, I, N, O, S, X and Z.)*

For titles of books about shapes and patterns, see the list of children's books in the Resources section at the end of this booklet.

Mathematics at the Grocery Store

The grocery store is one of the best examples of a place where the ability to use mathematics is put to work in the "real world." It's a great place to practice measurement and estimation and to learn about volume and quantity and their relationships to the sizes and shapes of containers—geometry!

One Potato, Two Potatoes

Preschool

Making a grocery shopping list can be both enjoyable and an opportunity to reinforce young children's number sense.

What You Need

- List of grocery items
- Color pictures of grocery items cut from magazines, catalogs or advertising flyers (for example, choose pictures of different kinds of vegetables, fruit, containers of milk or juice, cans of soup, boxes of cereal and crackers, loaves of bread)
- Index cards (or similar-sized cards cut from heavy paper)
- Glue stick
- Small box (large enough to hold the cards)

What to Do

- Put together the set of food pictures and help your child paste each picture onto a card. Then have your child sit with you as you make up a grocery shopping list. Read the list aloud to her, item by item, saying, for example, "We need to buy milk. Find the picture of the milk." When the child finds the picture, have her put it in the box. Continue through the list, asking her to find pictures of such things as apples, potatoes, bread, soup and juice.
- When you've finished, ask your child to tell you how many things you need to buy; then help her to count the pictures in the box.
- Ask your child to put all the pictures of vegetables in one group, then all the pictures of fruit in another group. (You might continue with items that are in cans, items that are in boxes and so on.)
- Point to one group of pictures, such as the fruit. Help her to count the number of pictures in that group. Have her do the same for other groups.

Use advertising flyers or newspaper advertisements to help your child identify, classify and count items. Ask, for example, "How many cans of soup are there?" "What vegetables do you see?" and so forth.

Ready, Set, Shop!

Kindergarten–Grade 1

Grocery shopping offers opportunities to let children apply a range of mathematics skills, including data collection and estimation.

What You Need

- Pencil and paper
- Calculator

What to Do

- To help your child learn about collecting data, involve him in making a shopping list for a special occasion, such as his birthday party. As you discuss what you need to buy, write out a list of grocery items. Then review the list with your child and tell him to make a check mark next to each item that you name. If you need more than one of an item, such as cartons of ice cream, tell him how many checks to make beside that item. Review the list with him and have him tell you what items—and how many of each—that you need to buy.
- Ask your child to choose something that he wants for dinner—a cake, a salad, tacos. Have him check to see what ingredients you already have; then ask him to help you make a shopping list. At the store, let him find each item on the list. Help him to compare

prices for different brands of the same items (such as boxes of cake mix) to see which items are the best buys.

- Ask your child questions such as, "Which is cheaper, this package of two tomatoes for $1.50 or three of these tomatoes at 60 cents each?" Have him estimate, then check his answer with a calculator.

Using the advertised prices in a newspaper or flyer to estimate the cost of items on a shopping list can help children sharpen their mental math and estimation abilities.

Get Into Shapes

Kindergarten–Grade 1

Introducing children to geometric principles can be as simple as helping them recognize how different shapes are used in common settings.

What to Do

- At the store, ask your child questions to focus her attention on the shapes that you see. Ask her to find, for example, items that have circles or triangles on them or boxes that are in the form of a cube or a rectangular solid.
- As you shop, point out shapes of products—rolls of paper towels, unusually shaped bottles, cookie boxes shaped like houses. Talk with your child about the shapes. Ask her why she thinks products, such as paper towels and packages of napkins, come in different shapes.

Have her notice which shapes stack easily. Try to find a stack of products that looks like a pyramid.

- Ask your child for reasons the shapes of products and packages are important to store owners. *(Some shapes stack more easily than others and can save space.)*

Before shopping trips, review different shapes with children by pointing them out in items around the house. Encourage them to use the correct name for each shape: square, rectangle, triangle, circle, cube, cylinder and so forth.

Clip and Save

Grades 1–2

Coupons can be used to help children learn the value of money as well as to let them show off their addition and subtraction skills.

What You Need

- Pennies, nickels, dimes, quarters
- Grocery store coupons
- Pencil and paper

What to Do

- Show your child a grocery store coupon for a product that he likes to eat and have him count out coins to show how much money the coupon saves on the product. For example, if the coupon is for 30 cents off a jar of peanut butter, give your child nickels and dimes and tell him to count out three dimes or six nickels. Give your child all the coins and challenge him to figure out how many different coin combinations he can make to total 30 cents.
- Ask your child how much money you can save with two or three 20-cent coupons. Show him the other coupons and ask him how much money could be saved with each one. Have him write the amounts and then add them to show how much could be saved if all the coupons were used.

Help children feel that they're a part of family budgeting by encouraging them to look in newspapers and flyers for coupons for items that the family uses. Have them look for coupons for items that they want to buy with allowance or birthday money.

Weighing In

Grades 3–4

Grocery shopping offers opportunities for children to increase their estimation and measurement skills by choosing and weighing fruit and vegetables.

What You Need

- A grocery scale

What to Do

- In the produce section of the store, explain to your child that what you pay for fruit and vegetables is based, in large part, on the quantity you buy and what it weighs—that produce is usually sold for a certain amount per pound. Tell her that pounds are divided into smaller parts called ounces, and it takes 16 ounces to make one pound. Show her the scale that is used to weigh produce.
- Gather the produce you want to buy and ask your child to weigh a few items. Then have her estimate the weight of another item before she weighs it. If you need one pound of apples, ask her to place several apples on the scale and then estimate how many apples she will have to add or take away to make one pound.
- Let your child choose two pieces of fruit, such as oranges. Have her hold one piece in each hand and guess which weighs more. Then have her use the scale to see if she is right.
- Ask your child questions such as the following to encourage her to think about measurement and estimation:

  —Will six potatoes weigh more or less than six oranges?

  —Which has more potatoes, a pound of big ones or a pound of little ones?

—How much do potatoes cost for each pound? If they cost 10 cents per pound, what is the total cost of the six potatoes?

- If your child knows the metric system (and the scale has a metric range), have her weigh items in grams and kilograms. Ask her to find out the following:

—How a kilogram compares to a pound.

—How many grams an apple weighs.

—How many kilograms (or kilograms plus grams) a sack of potatoes weighs.

—Which contains more apples, one pound or one kilogram?

—Which weighs more, one pound of apples or one kilogram of apples?

In many schools, children learn the metric system of meters, grams and liters, along with the more familiar system of feet, ounces and gallons. Practicing measurement both ways helps children learn both systems.

Check It Out

Grades 3–4

The checkout lane of a grocery store can be a good place for children to practice using mental math by estimating the cost of groceries and figuring out change.

What to Do

- As you wait in a grocery checkout lane, use the time to have your child estimate what the total cost of your groceries will be. Tell him that one easy way to estimate a total is to round off numbers. That is, if an item cost 98 cents, round it off to $1. Explain that the answer he gets won't be the exact cost, but it will be *about* that. Tell him that the word *about* shows that the amount you say is just an estimate.
- Using the estimated total, ask your child: "If the groceries cost $16 and I have a $20 bill, how much change should the checker give back to me? If the cost is $17.25, what coins is she likely to give me?
- At the checkout counter, ask your child to watch as the items are rung up. What's the actual total cost of the groceries? How does this amount compare to the estimate? When you pay for the items, will you get change back from your $20 bill, or will you have to give the checker more money?
- If you receive change, have your child count it to make sure the amount is correct.

Grocery shopping can be a good place to show children a practical use for calculators—for example, as a way to keep a running total of what the groceries cost.

Put It Away

Grades 1–5

Putting away groceries helps children develop classifying and mathematical reasoning skills and the ability to analyze data.

What You Need

- Groceries

What to Do

- Make a game out of putting away groceries. As you empty the bags, group the items according to some common feature. You might, for example, put together all the items that go in the refrigerator or all the items in cans.
- Tell your child that you're going to play "Guess My Rule." Explain that in this game, you sort the items and she has to guess what rule you used for grouping the items.
- After your child catches on to the game, reverse roles and ask her to use another "rule" to group these same items. She might, for example, group the refrigerator items into those that are in glass bottles or jars and those in other kinds of packaging. She might group the cans into those with vegetables, those with fruit and those with soup. When she's regrouped the items, guess what rule she used.

Children can often make up very creative rules for classifying things. Don't be surprised if you have trouble guessing your child's rule!

Mathematics on the Go

Most of us spend a lot of time moving from place to place in our cars or in cabs, on buses and on trains and in airplanes. Travel, whether across town or around the world, provides many opportunities for you to help your child learn about and apply math.

Off We Go

Preschool

Involving young children in trip planning can be a time to introduce them to measuring and comparing.

What You Need

- Maps
- Marker

What to Do

- Before your family leaves on a trip, sit with your child and show him a map that includes both where you live and where you're going. Talk with him about what maps are and how they are used. Use the marker to circle your hometown and then explain that this is where you live. Then circle the place you plan to visit and explain that this is where you're going. Draw a line between the two (a simple straight line—don't attempt to follow the highway route).

- Point out and mark other places that have meaning for your child—the place where his grandmother lives, the place where his favorite theme park is located and so forth, and do some simple comparisons of distance: "Grandma's is closer to us than where we're going on vacation. See. She lives here and where we're going is way over here." The idea is to familiarize your child with maps and distances, not to have him understand complicated directions or measurements.
- Use the map to play number and counting games as well: "Can you find three 2s?" "What is the route number on this road?" "How many rivers are in this state?"
- As part of getting ready for a long trip, involve your child in finding and counting things that should be packed—two shirts, three pairs of socks, five books and so forth.

Show children that you use math skills by "thinking out loud" as you do things such as measuring distances on a map: "Let's see, it's five miles to Jackson and then three miles from Jackson to Albany, so that's a total of eight miles. It's two miles from Jackson to Corbin, so that's a total of seven miles. Albany is further away from Jackson than Corbin is."

Are We There Yet?

Kindergarten–Grade 2

Traveling—whether by car, bus, train or plane—provides many opportunities for children to use mental math and estimation to solve time and distance problems.

What You Need

- Information about how far you're traveling and how long it will take
- Bus, train or plane schedule

What to Do

- On a routine trip around town, point out the time on a watch and say, for example, "It's 3:15, and it takes us 30 minutes to get to your dentist's office. Are we going to get there before your 4:15 appointment?"
- Show your child a bus, train or plane schedule and explain what it is and how to read it. Point out, for example, that a schedule shows when the bus leaves one place and when it arrives at another. Have her figure out how long it takes the bus to get to several places listed on the schedule.
- On a longer trip, occasionally ask your child to estimate how far you've traveled and how much longer it will take to get where you're going. Use road signs or schedules and timetables to help her check the answers.

Children develop positive attitudes toward math when they see that their parents and families value it. Find ways to show that you enjoy math. Let your child see you using math not only for routine activities, such as paying bills and following recipes, but also for fun, by playing number games and solving math puzzles.

Number Search

Kindergarten–Grade 3

Traveling provides children with lots of opportunities to practice number recognition as well as counting skills.

What You Need

- Paper
- Crayons or markers
- Ruler

What to Do

- Before you leave on a car trip, draw a "Number Search" grid, with five boxes across and 10 boxes down. In each box (moving across from the first box), write a number from 1 to 50. Make a copy of the grid for each family member (except, of course, the driver).
- As you travel, have family members play "Number Search." Tell everyone to be on the lookout for numbers and when they see one on a car or truck, a billboard, a sign, a building, or anything else, to point out the number, then circle it on the grid. (Only the person who spots the number first gets to circle it.) The first person to circle all the numbers on the grid wins.
- Ask your child to look for words and phrases on signs and billboards that have numbers (or number words) in them, such as "1-stop shopping," "2-day service," "buy one, get one free" and "open 24–7."

Helping children practice number recognition can take many forms. Encourage them to listen for common expressions that include numbers and number words, such as: "Two's company, three's a crowd"; "Two can play that game"; or "Three strikes and you're out."

License Plate Riddles

Grades 2–4

License plates can be used both to help children develop their knowledge of numbers and as an introduction to algebra.

What You Need

- License plates
- Paper
- Crayons or markers

What to Do

- If you're stuck in traffic, point out the license plate of a car in front of you and ask all family members (except the driver, of course!) to study it closely. Then tell everyone to use the individual numbers on the plate to make the largest three-digit number possible and write it down. For example, if the plate number is 254–116, the largest three-digit number that can be made is 654. Have each person read aloud his or her number. The person with the largest number wins the round. You can change the game by asking everyone to make the smallest three-digit number.
- For your younger child, these activities can be simplified by having them find the largest single or double digit, or even to recognize individual numbers or add all the numbers on the plate.
- Choose a license plate number, for example, 663M218. Then ask your child to use numbers from the plate to solve math problems such as the following:

—add two numbers to get the answer 5. *[answer: 3+2 = 5]*
—use three numbers to get 5. *[answer: (3+2) x 1 = 5]*
—use four numbers to get 5. *[answer: (6+3+1) ÷ 2 = 5]*
—use five numbers to get 5. *[answer: (6+6+3) - (8+2) = 5]*
—use six numbers to get 5. *[answer: (6+6) + (3x1) - (8+2) = 5]*

For fun, point out license plates on which numbers are part of a message: ALL 4 1; IML8 (I'm late).

License Plate Special

Grades 2–4

License plates can be used to reinforce children's understanding of the language of mathematics as well as their mathematical reasoning abilities.

What You Need

- License plates
- Paper
- Crayons or markers
- Ruler

What to Do

- As you travel in a car or on a bus with your child, point out a license plate and read it to him using only number names (excluding the letters).

For example, if the license plate is 663M218, read it as six hundred and sixty-three thousand two hundred and eighteen. Ask your child to find and read another license plate. Ask him if his number is less than, greater than or equal to yours.

- Ask your older child to estimate the difference between his number and another license plate number. Is the difference less than 10, more than 100, more than 1,000?
- Ask your child to write the names of the different states he sees on license plates (later he can check an atlas or dictionary for spellings—or you can help him use the abbreviations for each state). After the trip, ask him to tell you which state plates he saw most often. Which the least often? Help him to make a bar graph to show his findings.

It's important to help children to understand that numbers have the same value whether they are expressed in figures (1, 2, 3) or in words (one, two, three).

Ease on Down the Road

Grades 3–5

An important mathematical concept for children to learn is the relationship between two quantities such as *miles* per *hour* or *cost* per *gallon*.

What You Need

- Maps
- Marker
- Paper and pencil or pen

What to Do

On car trips with your child—short or long—take advantage of the following opportunities that allow him to apply his math skills:

- Before leaving on a trip, give him a map and tell him that you want him to be your "navigator" as you drive. Help him to mark the route that you will take. Then show him how to use distance numbers on the map to estimate the distances between different locations. Check the odometer before you begin the trip and have him write down the mileage.
- As you're driving, ask him to check the route marked on the map and let you know in advance when you'll need to turn onto another road—the name and about how far away it is. Point out road signs along the way that tell how many miles to a junction or town or city. Let him point out some for you.
- On the highway, ask your child to read road signs and look for signs that show the speed limits. Then ask him to watch the speedometer and let you know if you're driving too fast for the posted limit. Help him to practice his mental math skills by asking him questions such as, "The speed limit is 65 miles per hour. How far will we go in one hour? two hours? three hours? How long will it take us to go 500 miles?"
- When you stop for gasoline, ask your child to look at the pump to see how many gallons of gas you bought and the cost per gallon. If the gas cost $1.59 a gallon, ask your child what five gallons will cost. 10 gallons? 20 gallons? Ask him if he knows an easy way to figure this out. *(estimating the cost by rounding the cost per gallon to $1.60)*

- When you reach your destination, have your child write down the new mileage on your odometer. Show him how to figure the actual number of miles you traveled by subtracting the mileage when you left home from the new number. Then have him compare the actual mileage to the estimated mileage.

Involving children in planning trips and in giving them important jobs on the trip, such as following the correct route, can increase their self-confidence as well as their math skills. However, if they make mistakes, such as giving the wrong direction for a turn, they need to be reassured that mistakes are part of learning. Help them to understand what went wrong and how to get back on track.

Mathematics for the Fun of It

During summer vacations, on rainy days, while waiting at the doctor's office or on a stroll through the neighborhood, learning never ends. Children can explore some fascinating mathematical possibilities in the world around them every day. For instance, math can be found outdoors in nature: Look for symmetry in leaves; count the number, sizes and kinds of trees on your street; and look at the various shapes and patterns of blooming flowers. Children will be learning math and enjoying it, too! The activities in this section can be done anytime and anywhere.

A Tower of Numbers

Preschool

Playing with blocks is fun, but it also can teach basic math skills such as number recognition, counting, identifying patterns, recognizing symmetry and sorting.

What You Need

- Sets of blocks that show both numbers (1–10) and letters (at least A through J)

What to Do

- Give your child the blocks and tell her to sort them so that one set shows numbers and one set shows letters.
- Tell your child to look at the number blocks and choose the block with the number 1. Then have her build a tower by choosing and placing the remaining number blocks in the correct order. Have her say the name of each number as she places the block.
- Ask your child to build a second tower beside the first using only the letter blocks (beginning with "A") and placing them in order. Have her say the name of each letter as she places the block.
- Let her knock over the towers and scatter the blocks in front of her. Then tell her to use all the blocks to build a really big tower. When it's finished, have her find and point to numbers and letters as you say the names.

- Ask your child to use the blocks to make the following patterns:

  —one number, two letters
  —one letter, one number, two letters
  —A, 5, B, 4, C, 3
  —1, 2, E, F

Young children can easily confuse letters and numbers. Throughout the day, have them notice and name both, or ask questions such as, "See the sign on that bus. Does it say 5 or E?"

Count It Out

Preschool–Kindergarten

Counting games make developing number sense easy and fun.

What You Need

- A group of 20–25 counters (beads, blocks, plastic eggs, coins), with three or four counters different from the others in some way (for example, red beads in a group of blue beads; dimes in a group of pennies)
- Dice

What to Do

- Sit on the floor with your child and arrange the counters in a circle between you. Have her toss the dice and say the number that comes up. Tell her to start at any point in the circle—except for one of the counters that is "different"—and count to that number, touching each counter as she goes.
- If she stops on a "regular" counter (a blue bead), she gets to take the counter and have another turn. If she stops on the different counter (the red bead), you get a turn. Leave the different counter in the circle.
- The winner is the player with the most counters when only the different counters remain. Involve the family and expand the game!

Be sure to use counters that are small enough for small hands to move but large enough not to pose a choking hazard.

Guess What I'm Thinking

Kindergarten–Grade 2

Games give children a chance to use math skills and math language in a non-threatening situation.

What to Do

- Let your child think of a number within a range of numbers. Try to guess the number by asking him questions. Here's a sample:

(for kindergarten children)
Child: I am thinking of a number between 1 and 10.
Parent: Is it more than 6?
Child: No.
Parent: Is it less than 3?
Child: No.
(The child could be thinking of 4 or 5.)

(for first and second graders)
Child: I am thinking of a number between 1 and 100.
Parent: Is it more than 50?
Child: No.
Parent: Is it an even number?
Child: No.
Parent: Is it more than 20 but less than 40?
Child: Yes.
Parent: Can you reach it by starting at 20 and counting by 5s?
Child: Yes.
(The child could be thinking of 25, 30, or 35.)

- After you've guessed your child's number, let him guess a number that you're thinking of by asking similar questions.

It is important to help children develop an understanding of the characteristics of numbers—such as odd and even—and meanings of terms such as "more than" and "less than."

Open for Business

Grades 1-5

Learning to use a calculator can help children understand and apply estimation and mathematical reasoning skills, as well as learn addition, subtraction, division and multiplication.

What You Need

- Empty containers (cartons or boxes)
- Old magazines, books, newspapers
- Calculator
- Pencil or crayon
- Paper

What to Do

- Help your child collect empty containers so that you can play as if you were shopping at the grocery store. Gather the items and put them on a table. Help think of a price for each item. Mark the prices on the containers. You can even mark some items on sale.
- Pretend to be the customer while your child is the cashier. Ask questions such as the following:

  —How much would it cost to buy three cartons of eggs?
  —If the price of soap is $5 for two bars, then how much does one bar of soap cost?
  —If I don't buy the cereal, how much is my bill?
  —How much more will it cost if I buy this magazine?

- Show your older child how math symbols (for example, +, -, ÷, x and =) are used on a calculator. Help her add the prices of each item on the calculator and total the amount using the (=) symbol. Have her write the total on a piece of paper, which will be your receipt.
- Have your child estimate the total cost of the items you are buying. Have her use a calculator to see if her estimate is correct.

Learning to use calculators is important for children—they're part of everyday life. However, they are no replacement for strong arithmetic. Children should not be encouraged to rely too heavily on calculators.

What Coins Do I Have?

Grades 2–5

Using mathematical reasoning skills to figure out the unknown is good preparation for understanding algebra.

What You Need

- Coins of different denominations
- Paper
- Pen or pencil

What to Do

- Choose coins so that your child can't see, then hold out your closed hand and ask her questions such as the following:

  —I have three coins in my hand. They're worth 7 cents. What coins do I have? *(a nickel and 2 pennies)*
  —I have three coins in my hand. They're worth 16 cents. What coins do I have? *(a dime, a nickel, a penny)*
  —I have three coins in my hand. They're worth 11 cents. What coins do I have? *(2 nickels and 1 penny)*
  —I have three coins in my hand. They're worth 30 cents. What coins do I have? *(3 dimes)* Ask your child to tell you how she knows the answer.
- Make the game more challenging by asking questions that have more than one answer:

  —I have six coins in my hand. They're worth 30 cents. What coins could I have? *(1 quarter and 5 pennies or 6 nickels)*.
  —I have coins in my hand that are worth 11 cents. How many coins could I have? *(2—1 dime and 1 penny; 3—2 nickels and 1 penny; 6—1 nickel and 6 pennies; 11—all pennies)* Again, ask your child to tell you how she knows the answer.

You get the idea! Give your child coins to figure out the answers.

Games that involve math should be fun for children, so keep it light!

What Are My Chances?

Grades 2–5

Playing games that involve chance is one way to introduce children to the meaning of probability.

What You Need

- Two coins
- Paper and pencil

What to Do

Play these coin games with your child:

- Flip one coin. Every time it comes up heads, your child gets 1 point. Every time it comes up tails, you get 1 point. Flip it 50 times. Tally by 5s to make it easier to keep track of scores. The player with the most points wins. If one player has 10 points more than the other person does, he scores an extra 10 points. Ask your child to notice how often this happens. *(Not very often!)*
- Flip two coins. If the coins come up two tails or two heads, your child scores 1 point. If it comes up heads and tails, you get 1 point. After 50 flips, see who has more points. Ask your child if he thinks this game is fair. What would happen if one player received 2 points for every double heads and the other player received 1 point for everything else. Would that be fair?
- Flip one coin. Then flip the other. If the second coin matches the first coin, your child scores 1 point. If the second coin doesn't match the first coin, you receive 1 point. Try this 50 times. Is the result the same as in the previous game?

Call attention to the role that probability plays in everyday life by pointing out how it is used in TV weather forecasts or sports stories.

Card Smarts

Variations for All Grades

Games with number cards can help children develop strategies for using numbers in different combinations by adding, subtracting, multiplying and dividing.

What You Need

- Sets of number cards, 1-10 (you can make your own using heavy paper or index cards)
- Pencil and paper
- Coin

What to Do

Here are some games that you and your child can play with number cards:

- Number Sandwich With your younger child, review the numbers 1 through 10. Make sure that he knows the correct order of the numbers. Sit with him and shuffle and place two sets of number cards in a pile between you. Have him draw two cards from the pile and arrange them in order in front of him, for example 3 and 6, leaving a space between. Then have him draw a third card. Ask him where the card should be placed to be in the right order—in the middle? before the 3? after the 6?
- More or less? Sit with your younger child and place a shuffled set of number cards between you. Flip the coin and have your child call "heads" or "tails" to see if the winner of each round will be the person with a greater value card (heads) or a smaller value card (tails). Then each of you will draw a card. Compare the cards to see who wins that round. Continue through all the cards. When your child is comfortable with this game, change it just a bit. Divide the cards evenly between the two of you. Each of you places the cards face down and turns over one card at the same time. Have your child compare the cards to see if his card is more or less than yours. If his card is more than yours, ask him how much more. If it is less, ask how much less. The player with the greater or smaller value card (depending on whether heads or tails was tossed) takes both cards. The winner of the game is the player with more cards when the cards have all been used.

- Make a number This game is for your older child and can be played with family and friends. Give each player a piece of paper and a pencil. Deal each player four number cards with the numbers showing. Explain that, using all four cards and a choice of any combination of addition, subtraction, multiplication and division, the player must make as many different numbers as possible in two minutes. The player gets one point for each answer.

Encourage children to use number cards to make up their own games for the family to play.

Calculated Answers

Variations for All Grades

Learning to use the special functions of calculators can expand children's knowledge of many arithmetic operations, help them to recognize number patterns and increase their ability to reason mathematically.

What You Need

- Calculator with counting function

What to Do

- Give your child a calculator that is appropriate for his age (one with large, easy-to-read keys is especially helpful). Show him how he can make the calculator "count" in sequence for him. (For most calculators, this is done by pushing a number button, then the + sign, then the button for the number to be added, then the = sign: for example: 1 + 1 =. To make the calculator count in sequence by adding 1, keep pushing the = button: 1 + 1 = 2 . . . 3. . . 4 . . . 5 and so on). Give the calculator to your child and have him try this, starting with 1 + 1.
- When your child is comfortable with this function, have him explore number patterns such as 2 + 2 =, 5 + 5 =, 50 + 50 =, and so forth.
- Next, show your child that he can use the same procedure to subtract—by substituting the – sign for the + sign: 50 – 1 =, or 100 – 5 = . Encourage him to explore other patterns.
- Let your older child learn about negative numbers by seeing what the calculator shows when they count down from 0 (for example, 0 – 2 = -2).

- Create number pattern puzzles for your child to solve. Try the following:

—Write a sequence of numbers that follows a pattern, such as 3, 6, 9, 12. Ask your child what number comes next. Have him explain what the pattern is (*counting by 3s*).
—Have your older child fill in missing numbers in patterns, such as 43, 38, ____, , ____, 23, ____, 13. Ask him what the pattern is. (*subtracting by 5s*)
—Have your child create number patterns for you to identify.

Asking children to explain in their own words how they arrive at a solution to a problem—including how they used a calculator—encourages them to get into the habit of thinking and reasoning mathematically.

Glossary

Algebra: A form of advanced arithmetic in which letters of the alphabet represent unknown numbers. Children use simple algebra when they solve a problem such as 4 + ? =7 (a problem they would phrase as "4 + x = 7" when they get older and begin to study algebra).

Arithmetic: A branch of mathematics taught to youngsters in elementary school. It deals with numbers and how to use them in the operations of addition, subtraction, multiplication and division.

Classification: Identifying ways in which objects are similar (such as color, size or shape).

Geometry: A branch of mathematics that deals with measurement, properties and relationships of points, lines, angles, surfaces and solids. For young children, geometry begins by recognizing shapes and patterns; formal study begins later.

Mathematical reasoning: Thinking through math problems logically in order to arrive at solutions. It involves being able to identify what is important and unimportant in solving a problem and to explain or justify a solution.

Measurement: Determining the length, area, volume, time and other quantities and using the appropriate tools to do so. Units of measure include inches, feet, grams, kilograms, pounds, tons, gallons, liters, dollars.

Number sense: The ability to recognize numbers, identify their relative values and understand how to use them in a variety of ways, such as counting, measuring or estimating.

Probability: The chance that a given event will occur. It is an important area of mathematics study and a subject to which young children can be introduced through games of chance, such as coin tosses.

Statistics and data analysis: The collection and analysis of numerical data. Counting people in a census is a statistical activity. So is computing a batting average or figuring the miles per gallon that your car averages on a trip.

Symmetry: The property of an object when the characteristics (size, shape and relative position of parts) are the same on either side of a dividing line or about a center.

What Does Effective Mathematics Instruction Look Like?

As a result of recent efforts to strengthen the mathematics curricula in our nation's schools, from basic through more advanced levels, the instruction that you can see in your child's mathematics classes may look quite a bit different from what you experienced when you were in elementary school. For instance, in effective math classrooms today, you can see the following:

Children are expected to know both basic arithmetic skills and the mathematical concepts that are the basis of these skills: They are learning and applying basic computational skills, and they will also be learning that mathematics is much more than knowing the "facts" and number operations. Young children are learning arithmetic—addition, subtraction, multiplication and division—and they also are using mathematical operations such as counting, measuring, weighing, reading charts and graphs and identifying patterns and shapes. Across the grades, children are practicing the use of their mathematics skills in many different ways, and they are using the language of math to talk about what they're doing. They are using mathematical operations that involve estimation, geometry, probability, statistics and the ability to interpret mathematical information. As they progress through school, children will increasingly show that they understand why they are using a particular math skill, recognize when they've made procedural errors and know what to do to correct those errors.

Children are involved actively in the study of mathematics: They are doing tasks that involve investigation, application and interpretation. They are talking about and writing explanations for their mathematical reasoning.

Children sometimes are working with one another: They sometimes collaborate to make discoveries, draw conclusions and discuss mathematical concepts and operations.

Children are striving to achieve high standards and are assessed regularly to determine their progress: *The No Child Left Behind Act of 2001* (NCLB) calls for all children to be taught math by teachers who have the training needed to teach effectively, using curricula that are grounded in scientifically based research. The law requires annual math assessments of students in grades 3-8 according to state-defined standards and dissemination of the results to parents, teachers, principals and others. Curriculum based on state standards should be taught in the classroom; thus assessment would be aligned with instruction. In addition to assessments required by NCLB, teachers are using many different ways to determine if children know and understand mathematics concepts. Some of these ways are open-ended questions in which a student writes out the steps—or thought processes—used in solving a math problem; independent projects; and other written tests.

Children are learning to use calculators appropriately: They are using calculators not as crutches but as tools for performing operations with large numbers. Use of a calculator will not replace a thorough knowledge of basic mathematical operations.

Children are using computers appropriately: They are using computers to run software that poses interesting problem situations that would not be available to them without the use of technology.

Here are some things that you can do to help your child be a successful mathematics student:

Visit your child's school. Meet with her teacher and ask how your child approaches mathematics. Does she enjoy it? Does she participate actively? Does she understand assignments and do them accurately? If the teacher indicates that your child has problems with math, ask for specific things that you can to help her.

Check math homework and other assignments. It's usually a good idea to check to see that your younger child has finished her math homework assignments. If your older child is having trouble finishing assignments, check her work, too. After your child's teacher returns math homework, have your child bring it home so that you can read the comments to see if she has done the assignment satisfactorily. **However, do not do homework for your child!** Limit your assistance to seeing that your child understands the assignments and that she has the necessary supplies to do them. Too much parent involvement in homework can make children dependent—and takes away from the value of homework as a way for children to become independent and responsible.

Find out whether your child's teacher is highly qualified and whether the school follows state standards for mathematics instruction. Ask the school principal for a school handbook or math curriculum guide. If your school doesn't have a handbook, ask the principal and teachers questions such as the following:

—What math teaching methods and materials are used? Are the methods used to teach math based on scientific evidence about what works best? Are materials up to date?
—How much time is spent on math instruction?
—How does the school measure student progress in math? What tests does it use? How do the students at the school score on state assessments of math?
—Does the school follow state math standards and guidelines?
—Are the math teachers highly qualified? Do they meet state certification and subject-area knowledge requirements?

If you have not seen it, ask to look at the *No Child Left Behind* report card for your school. These report cards show how your school compares to others in the district and indicate how well it is succeeding.

Find out if the school has a Web site and, if so, get the address. School Web sites can provide you with ready access to all kinds of information, including homework assignments, class schedules, lesson plans and dates for school district and state tests.

Help your child see that the mathematics he is learning is very much a part of everyday life. From statistics in sports to the sale price of clothing to the amount of gas needed to travel from one city to another, mathematics is important to us every day. Help your child to link his "school" math to practical events.

Point out that many jobs require mathematical skills. Your child may recognize that many people must have good math skills to do their jobs—scientists, doctors, computer technicians, accountants and bankers, for example. However, she may not realize that many other jobs also require math. Point out that math also is used in jobs such as running a business; being a plumber, carpenter, electrician or mechanic; being a salesperson or clerk; and designing clothes—or buildings. Let her know that having strong math skills will open up many great career opportunities.

Stimulate your child's interest in technology. Help your child learn how to use calculators—but don't let him rely solely on them to solve math problems. Encourage him to learn to use computers to extend what he is learning and to find math games and math-related Web sites that will increase his interest in math.

Show your child that you like mathematics. Letting your child see that you use math—and that you aren't afraid of it—will go much further to building positive attitudes than just telling her that she should learn it.

Set high standards for your child in mathematics achievement. Challenge your child to succeed in math and encourage his interest by doing the kinds of activities suggested in this booklet and by trying many more activities of your own.

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Resources

Federal Sources of Information

No Child Left Behind Parents Tool Box

Toll Free: 1-888-814-NCLB
www.nclb.gov/parents/index.html

The U.S. Department of Education's Mathematics and Science Initiative

Toll Free: 1-800-USA-LEARN
www.ed.gov/inits/mathscience/

Federal Resources for Educational Excellence (FREE)

www.ed.gov/free/index.htm/

Web Sites

In addition to the federal sources listed above, the following Web sites contain great links for both you and your child:

Educational REALMS: **www.stemworks.org**

Eisenhower National Clearinghouse for Mathematics and Science Education: **www.enc.org**

Family Education Network: **www.fen.com**

Figure This! Math Challenges for Families: **www.figurethis.org/index40.htm**

KidSource: **www.kidsource.com/kidsource/content/Learnmath8.html**

Links Learning: **www.linkslearning.org**

The Math Forum: **www.mathforum.org/parents.citizens.html**

Math in Daily Life: **www.learner.org/exhibits/dailymath/**

National Council of Teachers of Mathematics: **www.nctm.org/families/**

National Institute of Standards and Technology: **www.nist.gov/public_affairs/kids/kidsmain.htm**

National Science Foundation: **www.nsf.gov**

Newton's Window: **www.suzannesutton.com/**

Publications for Parents

Apelman, Maja and King, Julie. (1993). *Exploring Everyday Math: Ideas for Students, Teachers, and Parents.* Portsmouth, New Hampshire: Heinemann.

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Books for Children

The following is only a sampling of the many available math-related children's books that your child might enjoy. Please ask your local or school librarian to help you find other appropriate titles. Many of books listed here are also available in languages other than English. Your librarian can help you locate books in a particular language.

This list is divided into two groups, those books most appropriate for you to read with your younger child and those that will appeal to your older child, who reads independently. However, you're the best judge of which books are appropriate for your child, regardless of age.

Preschool—Grade 2

Adler, David A. *Fun With Fractions.* Holiday House.

Anno, Mitsumasa. *Anno's Math Games*. Philomel Books.

Axelrod, Amy. *Pigs at Odds: Fun With Math and Games.* Simon and Schuster.

Brown, Marc. *One Two Three: An Animal Counting Book*. Little Brown.

Burns, Marilyn. *The Greedy Triangle* (Brainy Day Books). Scholastic.

Carle, Eric. *1,2,3 to the Zoo.* Philomel Books.

Dee, Ruby. *Two Ways to Count to Ten*. Holt.

Demi. *Demi's Count the Animals 1 2 3.* Grosset and Dunlap.

Feelings, Muriel. *Moja Means One: Swahili Counting Book.* Dial.

Fox, Mem. *The Straight Line Wonder.* Mondo.

Greene, Rhonda G. *When a Line Bends, a Shape Begins.* Houghton Mifflin.

Hoban, Tana. *So Many Circles, So Many Squares.* Greenwillow.

Hopkins, Lee Bennett. *Marvelous Math: A Book of Poems.* Turtleback Books.

Hudson, Cheryl Willis. *Afro-Bets 1 2 3 Book.* Just Us Productions.

Hutchins, Pat. *The Doorbell Rang.* Greenwillow Books.

Jones, Carol. *This Old Man.* Houghton Mifflin Company.

Lionni, Leo. *Numbers to Talk About.* Pantheon Books.

Miller, Jane. *Farm Counting Book.* Aladdin Library.

Pinczes, Elinor J. *A Remainder of One*. Houghton Mifflin.

Pluckrose, Henry. *Numbers and Counting: Let's Explore.* Gareth Stevens.

Schwartz, David M. *How Much Is a Million?* Scholastic

Scieszka, Jon. *Math Curse.* Viking.

Tafuri, Nancy. *Who's Counting?* Mulberry Books.

Ziefert, Harriet. *A Dozen Ducklings Lost and Found: A Counting Story.* Houghton Mifflin/Walter Lorraine Books.

Grades 3–5

Adler, David A. *Shape Up! Fun With Triangles and Other Polygons.* Holiday House.

Burns, Marilyn. *I Hate Mathematics!* (A Brown Paper School Book). Little, Brown.

Clement, Rod. *Counting on Frank.* Gareth Stevens.

Garland, Trudi H. *Fibonacci Fun: Fascinating Activities With Intriguing Numbers.* Dale Seymour Publications.

Holub, Joan. *Riddle-Iculous Math.* Albert Whitman.

Julius, Edward K. *Arithmatricks: 50 Easy Ways to Add, Subtract, Multiply and Divide Without a Calculator*. John Wiley & Sons.

Lopresti, Angeline Sparagna. *A Place for Zero: A Math Adventure.* Charlesbridge Publishing.

Murphy, Stuart J. Sluggers' *Car Wash*. HarperCollins.

Neuschwander, Cindy. *Sir Cumference and the First Round Table: A Math Adventure*. Charlesbridge Publishing.

Pappas, Theoni. *Fractals, Googols and Other Mathematical Tales.* Wide World Publishing.

Peterson, Ivars and Henderson, Nancy. *Math Trek: Adventures in the Math Zone.* John Wiley & Sons.

Schmandt-Besserat, Denise. *The History of Counting*. HarperCollins.

Swartz, David M. *G Is for Googol: A Math Alphabet Book*. Triangle Press.

Tang, Greg. *The Grapes of Math: Mind Stretching Math Riddles.* Scholastic.

Viorst, Judith. Alexander *Who Used to Be Rich Last Sunday.* Atheneum.

Wise, Bill. *Whodunit Math Puzzles.* Sterling.

Zaslavsky, Claudia. *Math Games & Activities From Around the World.* Chicago Review Press.

Math Software

Many Web sites provide information and reviews that you can use to select the best mathematics software for your child. Here are just a few of those Web sites:

Children's Math Software:
www.educational-software-directory.net/children's/math.html

Learning Village: **www.learningvillage.com/**

SuperKids (the educational software review page): **www.superkids.com**

Viewz: **www.viewz.com/reviews/**

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No Child Left Behind

On January 8, 2002, President George W. Bush signed into law the *No Child Left Behind Act of 2001* (NCLB). This new law represents his education reform plan and contains the most sweeping changes to the Elementary and Secondary Education Act since it was enacted in 1965. It changes the federal role in education by asking America's schools to describe their success in terms of what each student accomplishes. The act contains the president's four basic education reform principles:

- Stronger accountability for results;
- Local control and flexibility;
- Expanded options for parents; and
- An emphasis on effective and proven teaching methods.

In sum, this law—in partnership with parents, communities, school leadership and classroom teachers—will ensure that every child in America receives a great education and that no child is left behind.

For more information on No Child Left Behind, visit the Web site at www.nochildleftbehind.gov or call 1-800-USA-LEARN.